sense of rectitude! Can we marvel that between two such natures, so differently ordered, and yet so complementary, there should ripen a friendship which both should reckon as the greatest gain of their lives?"

Who can fully gauge the influence of such a nature as Wöhler's? How it was exerted on Liebig is indicated in the following letter:—

"FREDERICK WÖHLER TO JUSTUS LIEBIG

"*Göttingen, March* 9, 1843

"To make war against Marchand, or, indeed, against anybody else, brings no contentment with it, and is of little use to science. . . . Imagine that it is the year 1900, when we are both dissolved into carbonic acid, water, and ammonia, and our ashes, it may be, are part of the bones of some dog which has despoiled our graves—who cares then whether we have lived in peace or anger; who thinks then of thy polemics, of the sacrifice of thy health and rest for science?—Nobody. But thy good ideas, the new facts which thou hast discovered, these, sifted from all that is immaterial, will be known and remembered to all time. But how comes it that I should advise the lion to eat sugar!"

It was thus in philosophic contentment, happy in his work, in his home life, and in his friendships, that Wöhler lived out his fourscore years and two. He made Göttingen famous as a school of chemistry; at the time of the one-and-twentieth year of his connection with the university it was found that upwards of 8000 students had listened to his lectures or worked in his laboratory. He was a man whom the world has delighted to honour; and there was hardly an academy of science or a learned society which has not in some way or other recognised his services to science. He was made a Foreign Member of the Royal Society in 1854, a Corresponding Member of the Berlin Academy in 1855, Foreign Associate of the Institute of France in 1864, and in 1872 he received the Copley Medal from the Royal Society. On September 23, 1882—

"He gave his honours to the world again,
His blessed part to heaven, and slept in peace."

METEORIC DUST

SIR WILLIAM THOMSON has sent us the following communication for publication:—

"*Portkil, Kilcreggan, March* 13, 1884

"DEAR SIR WILLIAM THOMSON,—Herewith I inclose some of the meteoric dust collected on a cotton filter, and both ignited at a red heat. The change of colour is interesting.

"On Saturday, March 1, the snow lay 5½ inches deep at 8 a.m., pure and white. At 9.15 a.m., when I next noticed it, it was sooty looking, the blackish appearance penetrating half an inch only. The sky was clear and calm, any tendency to movement of the air being from the south-east.

"I carefully measured a superficial foot on an outlying field sloping to the south-west at a spot bisected by the 200-foot line of the Ordnance Survey, and collected the snow into two bowls of white delft, half into each. After evaporating the snow water, thoroughly drying the residue, I collected and weighed it, that from one giving 1⅞ grains, and the other 2⅛ grains, or 4 grains to the square foot exactly.

"I can personally vouch for the dust being all over the Roseneath peninsula, as I trudged through the snow to Coulport on Loch Long, and found it the same all the way north, also on the top of the Gallow-hill (414 feet). I have since seen those who noticed it at Garelochhead, so that on this peninsula alone, taking 4 grains as an average, there has fallen over 100 tons.

"From hearsay it appears to have been noticed from Kippen on the north to Largs on the south, and from Hamilton on the east to Dunoon on the west, or over an area (in round numbers) of 810 square miles, and admitting the former estimate, we have the astonishing aggregate of say 5760 tons! A weighty gift to Mother Earth, surely of some value.

"I should mention that every crack, scratch, or depression in the glaze of the bowls was filled with the finely divided matter; it was impossible, therefore, to collect it *all* for weighing, consequently 4 grains per square foot is under rather than over the probable average. The observer at Kippen, too, mentions that the snow was permeated there for one inch by the sooty appearance.

"On Monday (March 3), after snow had fallen to the depth of an additional 8 inches, I watched for a recurrence of the phenomenon, and on the sky clearing about midnight I fetched in a dish that I had left outside and found a little had fallen in small flakes; these had melted their way through the snow, leaving little tunnels about the size of crow-quills. The quantity, however, was exceedingly small. Tendency to movement of the air as before from the south-east. Barometer had risen from 29·4 at 2 p.m. to 29·6, steady at midnight, thermometer 42°. On Saturday previous barometer stood at 30·05 (90 feet above sea-level, aneroid), thermometer 44°, 12 noon. The dust I left with you previously contains a little organic matter (grassy fibre), though what I had under the microscope appeared entirely metallic.

"The snow had melted a good deal before I recognised the importance of obtaining a fair sample. My children, however, had rolled a huge snowball down the slope, at the top of which the cottage stands, and this had increased as it rolled until it was something like 6 feet in diameter, and so formed a mine from which to collect the dust. There is still some of the black water in process of evaporation; should you require it more of the dust is at your service.

"One of the older inhabitants remembers a similar occurrence here in 1828 on the 20th or 22nd of March, when the snow, he says, fell in black or sooty flakes.

"Perhaps it is well to mention that the goats suffered somewhat from influenza on Sunday and Monday, and that I myself had a sharp attack followed by severe headache for a day, caused probably by inhaling a minute quantity of the dust snuff fashion. It might have been from something else, only the coincidence is suggestive of caution.

"I am, yours faithfully,

"LEWIS P. MUIRHEAD

"Professor Sir William Thomson, Glasgow University"

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The Boards for Medicine, Physics and Chemistry, and Biology and Geology, after joint deliberation, have recommended an important change in the appointments of Natural Science Examiners. It has been a regulation of the Natural Science Tripos that all answers shall be looked over by two examiners out of the eight, but it has become increasingly difficult to find examiners with the requisite extent of knowledge. Thus it practically happens that each examiner is sole examiner in a single subject, and the places of candidates are often practically dependent on the judgment of a single examiner to an extent unknown in the other Triposes. It is now recommended that two examiners shall be appointed in each subject of Natural Science, to undertake all the University Examinations in that subject, and thus the Natural Sciences Tripos, the Special Examinations for the ordinary B.A., and portions of the M.B. Examinations, will be brought into one system. The examiners should never both be changed at the same time. The payments recommended are—for each examiner in Physics and in Chemistry, 50*l.*; in Botany, Zoology, Human Anatomy, and Physiology, 40*l.*; in Geology, 20*l.*; and Mineralogy, 10*l.*

SCIENTIFIC SERIALS

Journal of the Franklin Institute, No. 697, January.—W. Dennis Marks, note on the losses per horse-power by condensation of steam in pipes and cylinders of engines.—De Volson Wood, the cheapest point of cut-off.—Prof. R. H. Thurston, the theory of turbines. This is the conclusion of a very valuable mathematical paper given in a very full abstract.—B. N. Clark, water-line defence and gun-shields for cruisers.—W. Dennis Marks, economy of compound engines.—Prof. E. J. Houston, the Delany synchronous-multiplex system of telegraphy. This invention is founded on La Cour's phonic wheel, and bids fair to supersede harmonic multiple telegraphs.

Annalen der Physik und Chemie, xxi. January.—O. Fröhlich, measurements of sun-heat. Describes amongst other matters a new pyrheliometer with a special thermopile arrangement.—A. W. Velten, the specific heat of water. The results confirm Regnault's values.—E. Pirani, on galvanic polarisation. The values are estimated by a compensation method.—W. Hittorf,

on electric conductivity of gases (first part).—A. Oberbeck, on electric oscillations and on phenomena of polarisation caused thereby.—A. Toepler, on the estimation of horizontal magnetic intensity by use of the balance.—W. von Bezold, a simple experiment on the connection between the temperature of an incandescent wire and the composition of the light emitted by it. A platinum wire is stretched horizontally through the tip of a Bunsen burner and examined in a spectroscope with horizontal slit.—E. Ketteler, reply to Herr Voigt's criticisms.

No. 2, February.—S. Czapski, on the thermal variation of the electromotive force of galvanic batteries, and its relation to their free energy.—J. Kollert, on the properties of flame in their electrical relation. Confirms the previous measurements of Elster and Geitel.—F. Fuchs, on a compensation-method for estimation of the resistance of unpolarisable elements. A modification of Poggendorff's well-known method.—E. Budde, on the theory of thermo-electric forces.—H. Lorberg, on electrostriction. A discussion of Quincke's results.—B. Weinstein, on the calculation of the potential of coils. A mathematical paper.—A. von Waltenhofen, on an instructive experiment which may be made with asymmetrical thermopiles. On passing an independent current through the thermopile certain non-reversible phenomena of polarisation are observed arising from the asymmetry of the junctions that are heated.—C. Christiansen, on the emission of heat from uneven surfaces.—A. Tschirch, researches on chlorophyll and some of its derivatives.—W. Holtz, a lecture experiment in proof of the law that the velocity of rotation increases as the rotating masses approach the axis.

Journal de Physique, tome iii. No. 2, February.—G. Lippmann, physical definition and determination of absolute temperatures. This is the first part of a communication in which the author seeks to find stricter thermodynamic definitions of temperature. He attributes to Carnot the discovery of the scale of absolute temperature!—D. Gernez, researches on the duration of the solidification of sulphur, and on a new variety of sulphur. The crystallisation in octahedra takes from 25 to 100 times as long as the crystallisation in rhombic prisms. The new crystalline kind obtained by M. Gernez is in the form of very elongated prisms of a nacreous texture. They are produced by rubbing the side of the test-tube containing the surfused sulphur with the end of a platinum wire or glass rod. When these crystals are introduced into surfused sulphur, they determine a growth of similar crystals throughout the mass; and the formation is much more rapid than that of either of the previously known forms.—E. Mathieu, suspension of a liquid by a capillary vertical tube.—E. Mathieu, modification of the pressure of a liquid by capillary forces.

Rendiconti del R. Istituto Lombardo, Milan, January 24.—Biographical memoir of Emilio Cornalia (1824–1883), by Prof. Leopoldo Maggi.—Necrological notice of the late Camillo Hajech.—*Résumé* of the meteorological observations made at the Brera Observatory, Milan, during the year 1883, by E. Pini.—Some applications of Cournat's principle of least effort to the equilibrium of linked systems (theoretical mechanics), by Prof. G. Bardelli.—Meteorological observations made at the Brera Observatory during the month of January, 1884.

SOCIETIES AND ACADEMIES

LONDON

Mathematical Society, March 13.—Prof. Henrici, F.R.S., president, and subsequently Mr. S. Roberts, F.R.S., vice-president, in the chair.—The Rev. A. C. E. Blomfield, Messrs. J. Chevallier, E. H. Hayes, R. S. Heath, and Prof. J. Larmor were elected Members.—Mr. Tucker read a paper by Prof. M. J. M. Hill on the closed funicular polygons belonging to a system of coplanar forces having a single resultant; and communicated a paper by Prof. J. Larmor, on the direct application of the principle of least action to dynamical analogues.—Mr. J. W. L. Glaisher, F.R.S., read a paper on the square of Euler's series.—Mr. J. J. Walker, F.R.S., communicated a note by Mr. J. Griffiths, further results from a theory of transformation of elliptic functions.—Mr. S. Roberts, F.R.S., read a note concerning the Pellian equation.

Physical Society, March 8.—Prof. Guthrie, president, in the chair.—Lord Rayleigh read a paper on the electro-chemical equivalent of silver. The determination was made by a method described to the last meeting of the British Association at Southampton, which consists in using two fixed coils and a movable coil suspended between these from one end of a balanced beam. These coils are in circuit with the current and voltameter. The current is reversed in the fixed coils at intervals of five minutes, and the weight required to bring the balance even is noted. The calculation of the effect by this method is independent of the precise measurement of the coils. Two or more silver voltameters were in circuit, nitrate of silver being the solution used. Careful precautions of various kinds were taken, and the result was that unit C.G.S. current deposits $1{\cdot}118 \times 10^{-2}$. It follows that 1 ampere will deposit 4·025 grm. of silver per hour.—Lord Rayleigh also read a paper on the absolute electromotive force of Clark's cell. Experiments made at the Cavendish Laboratory gave the electromotive force of this cell as 1·453 volts. The accepted value is 1·457 volts. If the B.A. unit (as Lord Rayleigh believes) is about ·9867 of a true ohm, the result, 1·453, becomes 1·434 volts.—Lord Rayleigh also mentioned that he had been making experiments on the rotation of the plane of polarised light in bisulphide of carbon, and obtained a result agreeing more nearly with Gordon's than with Becquerel's.—Profs. Guthrie and Ayrton spoke on the papers, the former eliciting the reply that electro-corrosion was less satisfactory than electro-deposition for determining the equivalent; and the latter that silver was better than copper for accurate results in the voltameter.—Mr. Shelford Bidwell, M.A., read a paper on some experiments illustrating an explanation of Hall's phenomenon. By these experiments Mr. Bidwell sought to explain Hall's effect through a combination of mechanical stress and the well-known Peltier effect on the thin metal plate which is placed between the poles of the magnet. He repeated many of the experiments, and showed how he had obtained the same results as Hall, except in the case of aluminium, which he found to be + like iron, whereas Hall made it −. Mr. Bidwell reversed the effect by cutting two slits in the strip of metal, thereby altering the stress on it. Righi's effect was also explained on the same grounds. Mr. Walter Browne said that difference in the quality of the aluminium might explain the anomaly with this metal. Prof. Perry criticised the explanation of the slitted plate, and Prof. G. C. Foster suggested that results in absolute measure should be obtained.

EDINBURGH

Royal Society, February 18.—Sheriff Forbes Irvine, vice-president, in the chair.—Prof. Tait read a paper on radiation, in which he called attention to Stewart's papers of 1858 as containing, so far as it has yet been developed, the theory of exchanges. Yet, in the most recent authoritative treatise on the subject, the name of Stewart is not even once mentioned. The basis of the whole theory is Carnot's principle, and therefore no demonstration can be considered absolutely rigorous. Thus it is probable that as there are very hot particles in a gas at ordinary temperatures, so there may be feeble radiation of high wave-lengths from a black body at ordinary temperatures.—Mr. Saug read a paper on the need for decimal subdivisions in astronomy, trigonometry, and navigation, in which he pointed out the inconvenience of the sexagesimal system, and estimated it as doubling the labour of calculation. The decimal division of the second, used throughout the *Nautical Almanac*, was appealed to as evidence of the need for a change. The paper was accompanied by a number of tables suited to the decimal division of the quadrant, or useful therefor.—Prof. Ewing communicated a paper by A. Tanakadaté on an electromagnetic declinometer.—Prof. Tait showed that when one polygon has its corners at the middle points of the sides of another, the condition that the first, second, or *n*th derived polygon shall be similar to the original, involves a singular equation in quaternion differences.—Prof. Tait also made some remarks on the basis of the theory of vortex atoms, pointing out that there is not necessarily any direct action between vortices in a perfect fluid; the present theory, which indicates such action, being based upon the assumed continuity of motion throughout the fluid.

PARIS

Academy of Sciences, March 10.—M. Rolland in the chair.—The election of M. G. Darboux was announced, as successor to the late M. Puiseux in the Section of Geometry.—On the forms presented by the nucleus of the Pons-Brooks comet on January 13 and 19 (one illustration), by M. Faye. The author rejects the explanation of these remarkable forms proposed by Bessel, who attributed to the nucleus a polarity like that of the magnetic forces. In virtue of this polarity the nucleus and ante-